Non-Intrusive, Real-Time, On-Line Temperature Sensor for Superheated Hydrogen at High Pressure and High Flow, Phase I

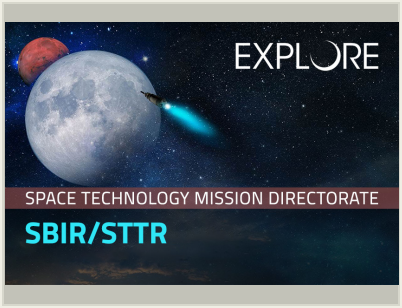
Completed Technology Project (2005 - 2006)

Project Introduction

The SSC needs a hydrogen temperature sensor that can provide high accuracy, fast response and can be operated on a superheated hydrogen (SHH2) environment. This will help prepare the SSC testing facility to support the new NASA mission for US space exploration as proposed by the President in January 2004. Here, we propose to develop an innovative, non-intrusive temperature sensor based on Spontaneous Raman Scattering (SRS). SRS has been known for years as a relatively simple analytical method. The goal of the proposed effort is to demonstrate a SRS sensor, which is able to provide millisecond sampling time for temperature measurements in SSH2. During Phase I, a SRS system based on a 0.5 spectrometer and ICCD detector will be used to find the best hydrogen bands for the temperature measurement. The fast response PMTube - based SRS system will then be designed for selected spectral lines. Experimental parameters will be evaluated to achieve optimum response time and sensitivity for this application. The study from Phase I will provide the necessary information to design a phase II prototype unit to achieve millisecond response time and better sensitivity in a compact package. In Phase II, the prototype SRS system will be developed and tested at the SSC and will be delivered to NASA/SSC for their evaluation.

Anticipated Benefits

The uses of a Raman sensor to measure superheat H2 temperatures has several other applications. This sensor, or a modified version, can also be used for hydrogen fuel technology, the generation of liquefied gases, gasification plants, various chemical industrial processes, and biomedical research. The sensor based on Raman spectroscopy developed for this proposal can be readily modified to measure the temperature in certain high temperature industrial furnaces. This hydrogen sensor can measure both low and high temperatures for gas or liquid phase. It can be used for combustion diagnostic and also as a hydrogen leak detector at facilities that produce and handle hydrogen.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Stennis Space Center (SSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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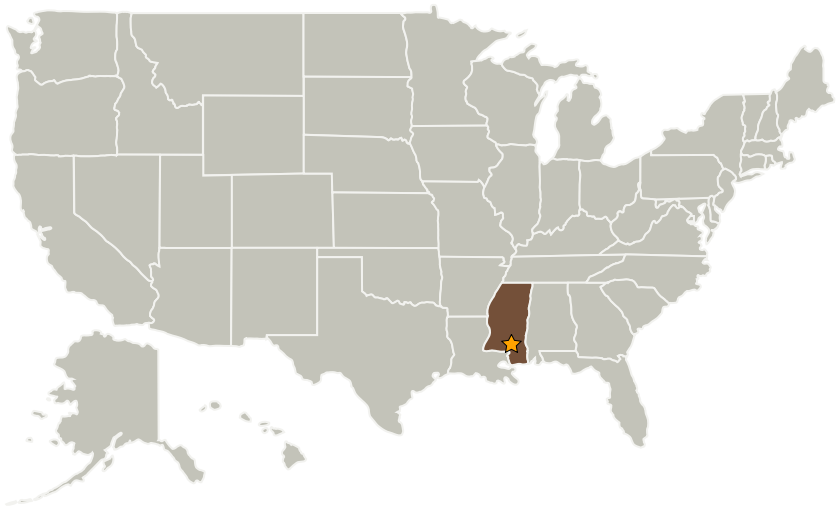
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Stennis Space Center(SSC)	Lead Organization	NASA Center	Stennis Space Center, Mississippi
Cook's Advanced Energy Conversion, LLC	Supporting Organization	Industry	Starkville, Mississippi

Primary U.S. Work Locations
Mississippi

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Project Manager:
Mark Hughes

Principal Investigator:
Jagdish Singh

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.3 In-Situ Instruments and Sensors
    - TX08.3.6 Extreme Environments Related to Critical System Health Management